

10.

Fishes That Rank Themselves Like Soldiers on Parade.

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(Plate I; Text-figures 1 & 2).

INTRODUCTION.

I have read that some mammals, such as the American bison and the antelopes of South Africa, advance, wheel and deploy in something like military order. But it is doubtful if they form in ranks with heads in a real military formation. We all know that migrating birds fly in fair formation and some writers have alleged that some aquatic birds will fish in synchronous order. But so far as known, no one seems to have produced photographic evidence of this latter alleged behavior.

For reptiles we apparently have no photographic evidence, but there are at least two written accounts that surely establish the matter of ranked formation. The first of these is from the pen of the old naturalist, William Bartram. In 1774 (*Travels through North and South Carolina, Georgia, and . . . Florida, etc.* London, 1792, p. 118), while ascending the St. Johns River in eastern Florida, he found great numbers of huge and very aggressive alligators. Some of these threatened attacks on his little boat, when he sought to go into a lagoon off the river to catch some fish for his supper. He says—"I . . . made good my entrance into the lagoon, though not without opposition from the alligators who formed a line across the entrance but did not pursue me into it." Here the alligators were ranked in a line, apparently waiting for the fishes to try to get out into the main stream, when the alligators too would get their supper.

This account is counterbalanced by a parallel description of what C. R. S. Pitman (*A Game Warden Among his Charges*, London, 1931, p. 248) saw just below Murchison Falls on the Nile River in East Central Africa, where crocodiles are found in incredible numbers. "Looking from above on a still evening, one will be struck by the regular formation taken up by row after row of crocodiles, like ships of war, with intervals of about 50 feet between each crocodile [and those on either side] and 300 feet between the rows, which extend from bank to bank and for about two miles down stream." But let a fish come down and all is wild confusion

and struggle of the neighboring crocodiles to get it or at least a portion of it.

The more we know about animals, the more we find them doing unusual and unexpected things. It is not safe offhandedly to contradict accounts by non-scientific observers of unusual behavior not otherwise physically impossible—in fishes, as well as in other animals. No article has been found in this search describing regimented fishes and bearing such a title as that at the head of this report. However, there is widely scattered evidence that fishes do "fall in and form ranks." Unfortunately, I have never had the opportunity to see fishes take on a military formation but various reputable observers have, and their cumulative evidence will now be set forth chronologically.

FISHES RANKED LIKE SOLDIERS ON PARADE.

The earliest account of ranked fishes found in this search is by a writer in *The New Monthly Magazine*, 1820, part II, p. 137, who signs himself "Amateur." This account is also found in Thomas Boosey's "Anecdotes of Fish and Fishing," London, 1887, p. 123.

"Amateur", in writing of the exploits of one Darcey of Oxford, an expert swimmer and diver, who caught fishes with his hands in a deep hole well-known to Oxonians, makes the following statement:—

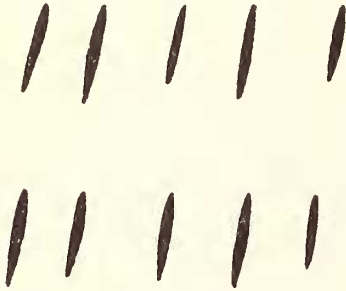
The report that Darcey made, was that many of these fish [barbel] lay with their heads against the bank, in parallel line, like horses in their stalls. They were not disturbed at his approach, but allowed him to come close and select the finest.

In talking over this unusual matter with my long-time friend, the late Dr. John L. Peters, an upstate New York man, he told me that in his boyhood he had seen this very thing in a stream in Ulster County. At my request he prepared a statement of his observations, which is the earliest American evidence that has come to hand.

In 1907 or 1908, while trout-fishing in the headwaters of Woodland Stream in Ulster Co., New York, my attention was called to the

peculiar formation of some brook trout after a disturbed pool had quieted down. They seemed to line up in a formation as if some military officer among them had got them ready for a parade. This I saw more than once since I used to go out of my way to watch the trout in this pool. When disturbed, they would scatter, but when things quieted down, they would again take on their military formation.

This pool was just below a little rapid in a narrow stream. It was about 8 feet wide, 3 feet deep at its head and about 6 or 8 inches at its shallow end. Dr. Peters drew a little diagram (Text-fig. 1) to show how the fishes were ranked.



TEXT-FIG. 1. Diagram of trout on parade, in Woodland Stream, Ulster County, New York, 1907 or 1908. Sketch by Dr. John L. Peters.

Chronologically our next evidence is in a personal communication from Mr. Joshua W. Atlee of Riverton, New Jersey. He wrote that in October, 1911, he saw ranked fishes in a pool in a rivulet flowing into the Bay of Chaleur, Gulf of St. Lawrence. Carefully pushing aside the shrubbery on the bank of the pool, he had a clear view of it and its piscine inhabitants, which he thought were getting ready for spawning. Of these fishes he noted that:

An interesting feature of the sight was the fact that in the slowly moving water, due to the [small] volume of the pool, the fish lay in "sardine fashion" closely packed with heads upstream, stemming the current so as to retain a similar relative position by the slight movement of their tails and fins.

Finally on being disturbed, some left the pool in various directions, mostly upstream; but my guide, detouring and getting into the stream above them, actually drove many of the trout back into the pool, where they finally settled down again as we had first found them.

My next evidence is from Mr. Howard B. MacDonald of Yonkers, N. Y., a traveler and lecturer of wide experience. A photograph taken by him at Rotorua, New Zealand, in 1925, is reproduced as Plate I, Fig. 1. Of it he wrote (personal communication) as follows:

Unfortunately, the photograph does not show the fish in quite such straight lines as the other picture you have. However, these fish I saw did act in the same manner as the ones you are studying. Each fish had a certain definite position in relation to the others of this company;

and if the fish were disturbed by throwing a stone into the water near them (as we all did) then they would scatter, but each would return almost immediately to his same position in the group. This was checked and verified by observation many times and there is no doubt but that each fish knew his correct position and always went to it.

Here is the word of another reliable observer, backed by photographic evidence. As Mr. MacDonald says, this is not such as may be seen in Plate I, Fig. 2, but discounting shadows, the fish are in pairs and they are lined up fairly well in ranked rows.

And now follows an excerpt from a personal communication from Dr. Louise M. Perry, long a winter resident of Sanibel Island off Fort Myers, southwest coast of Florida. Dr. Perry, an acute observer for many years of the habits of marine fishes in that region, writes as follows under date of July 26, 1926:

Naples, Florida [below Fort Myers], has a fine pier for still fishing, and while waiting for bites, I have repeatedly watched small schools of snook (rovalle) 8 or 12 in a group, lying on the sandy bottom, close together and parallel with each other, all heading the same way and all their tails gently moving to right and left in perfect unison. Suddenly with a rush they would dart into a school of minnows and play havoc for a moment, then each would gently settle down in its former place and position. This performance would be repeated at fairly regular intervals for a long time, and always made me wonder how separate individual actions could be so perfectly synchronized. How do they do it? What is the stimulus that keeps all the tails waving to marching time and starts the snook off in a simultaneous dash after the little fish?

Specific attention is called to the fact that all the tails of these marine fishes moved to right and left in perfect unison. And so did the tails of the freshwater fishes observed by Mr. Atlee in 1911 in the rivulet flowing into the Bay of Chaleur, Gulf of St. Lawrence. Presumably the same purpose activated both lots of fishes—to maintain position.

And now, also in 1926, come three accounts of this behavior of other marine fishes at the Galápagos Islands, from the pen of that veteran observer, William Beebe, in his "Arc-turus Adventure" (New York, 1926). On p. 54 he states that they paid out strings with pieces of bait and enticed three sharks alongside their boat. Here follows his description of the behavior of a large shark and its attendants.

... by pulling in the tempting morsel two feet in front of the eager blunt snouts, we brought them to the surface directly under our feet, so that we could watch the movements of the brilliant blue pilotfish, that . . . anticipated every movement of their huge patrons. One of the big fellows had three of these little satellites that unflinchingly held their formation, one just above his head, the other two in perfect alignment a few inches in front of his jaws. So exactly synchronized are the movements . . . that

it is impossible to tell whether the shark follows the pilotfish or the pilotfish the shark.

Again Beebe (1926, p. 183) notes that:

Two mighty schools of *Xesurus laticlavus* [the yellow-tailed surgeonfish] passed me grazing slowly. When within six feet, they left off their eternal feeding and formed up into more or less orderly ranks which flowed like some enormously long sea-serpent around the identical corners of rocks where had passed the leaders, yards and yards in advance. Invariably the formation of an irregular line led very close to me, the closing up of ranks evidently being connected with the presence of danger or at least something suspicious or strange.

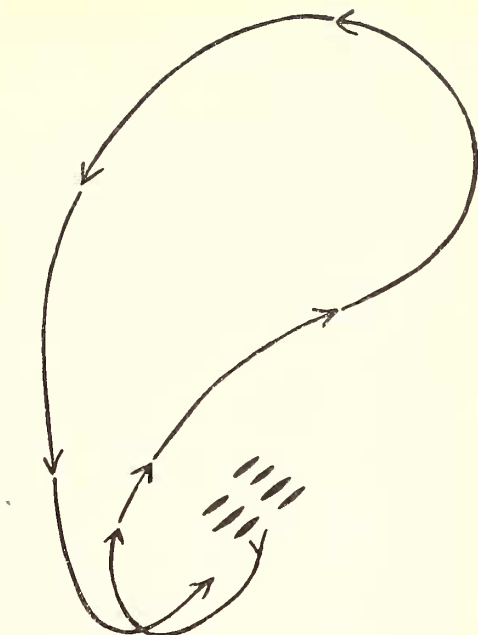
Further, Beebe (1926, pp. 290-291) makes note of another synchronous action of the yellow-tailed surgeonfish: "Several hundred approached swimming slowly along, when, as if at a signal, all would stop, and over a rather flat bottom would up-end like ducks and begin to graze ["on the plant and animal fodder which covers the rocks," p. 290].

On February 27, 1929, the late Prof. M. M. Metcalf wrote—"I am sending you some quotations [copied] from an old letter. These . . . aroused my interest at the time the observations were made some years ago." These observations were by another man, and lacking a name and date, will be entered under date (1929) of the covering letter. The pertinent quotation reads as follows:

. . . I saw in the clear pool below Trick Falls in the Two Medicine River in Glacier National Park seven trout behaving in a way that seemed interesting. They were headed into the current and were lying motionless in two perfectly straight rows, four in the front row and three in the back row, aligned as accurately as a squad of well drilled soldiers. A moth came flipping over the pool, touching the water now and then. All the trout remained quiet, except that the right trout in the rear row turned to the right and backed around the left end of the squad, caught the moth, returned around the left end of the squad to his place at the right end of the rear row again, and they all remained in perfect formation for the several minutes I watched them.

On the margin of the typed sheet is a pencil sketch of the movements of the trout at the right hand end of the second rank. This is reproduced herein as Text-fig. 2, and is a graphic presentation of the interesting action of this particular fish.

The well-known sports magazine, *Field and Stream*, for November, 1929, p. 104, has reproduced the splendid photograph shown in Plate I, Fig. 2. It is also reproduced (in larger size) in the same journal for June, 1935, p. 44. But in neither issue is there any account of the phenomenon, marvellous as it is. The 1929 figure has this caption: "A most extraordinary photograph of resting trout in the Brule River, 40 miles from Duluth, Minnesota. Note the very unusual formation—like soldiers on parade." The 1935 issue has a caption which remarks that "When great schools of fish lie in still water, it takes a



TEXT-FIG. 2. Trout in two ranks in Two Medicine River, Glacier National Park. The right trout in row two, backed out and followed the course indicated to catch a moth dipping in the water, and then returned to his position. Sketch furnished by Prof. M. M. Metcalf, 1929.

skillful angler to interest them" — and nothing about military formation in the article in which the figure is set.

Here is a priceless photograph showing eight rows of "trout on parade." It is apparently the only one ever published of this unique, indeed phenomenal, behavior of fishes, and there is no word of comment beyond the caption. It seems incredible, but such is the fact. However, the figure splendidly illustrates the accounts quoted above. But before going further, the present writer submits the following remarks.

Trout at rest in running water always face upstream. In pools, especially small ones, they are likely to do the same. In "trout water," such a pool always has a riffle or rapid at its head, and just below this the water is cooler and has more oxygen than ordinary. Gill-breathing is much easier in fishes facing upstream. Also, in such position, the fish can readily snap up any edibles coming down with the current. These would seem to explain, in part at least, the heads-upstream of this regiment of trout.

At first glance, in Plate I, Fig. 2, we see scores of trout in right-left ranks—fishes on parade—and the ranks separated by right-left stretches of gravel swept clean of fine detritus. Now let us recall that Mr. Atlee found ranked trout in the stream leading into the Bay of Chaleur, Gulf of St. Lawrence, maintaining their positions by moving their tails right and left in unison. Also Dr. Perry saw marine fishes at Naples, southwest coast

of Florida, acting in similar fashion. So we must conclude that the trout in Plate I, Fig. 2, were doing this very thing. Any given rank of trout fans out the fine detritus under the tails of its members. This is checked and some of it precipitated by the bodies of the rank of fishes just behind it—and so all the way from the foremost rank to the hindmost. Probably these rows of trout lie on gently backward sloping ridges of the detritus. This cleaning action holds best for the center of the stream but fades out somewhat on the edges where the current is weaker.

The collecting of data for an article on military fishes was begun more than 20 years ago. But the work went slowly and presently press of other work—particularly the editing of the Bashford Dean Memorial Volume—led to the filing away of all material till a more convenient time—which has just come. During this period of inactivity in this study; letters came in from a few persons who had heard of my interest in this problem. But their statements were in very general terms, and quite unclear. Had I taken the time to ask for more specific accounts of what they saw, I might have gotten additional valuable data. Now it is too late.

However, abundant evidence is to be found in the written accounts and in the sketches and photographs herein to establish the fact that various fishes, but especially trout, do rank themselves in parade order. These data certainly justify the title of this article. For

trout in running water, some tenable explanation has been advanced. But for trout and all other fishes, where behavior has been described, there must be a more fundamental universal reason. This no one has attempted—the explanation must be left to the animal behaviorists.

Finally, it may be said that, from the comments of several friends, who know of the work on this article, I am satisfied that this curious behavior of ranked fishes, "fishes on parade," is not at all uncommon. In fact, it is probably far better known than the present writer realizes. However, it is a curious thing that in this study there has not been found a single article with such an indicative title as this paper bears and it is hoped that others, who have witnessed this curious behavior, will publish their observations and thus establish this parade behavior as a normal procedure.

EXPLANATION OF THE PLATE.

PLATE I.

- Fig. 1. Ranked trout in a pool at Rotorua, New Zealand. Discounting the shadows, the trout are seen to be roughly ranked in pairs. Photograph by Howard B. MacDonald.
- Fig. 2. Resting trout in eight ranks, like soldiers on parade, photographed in the Brule River, 40 miles from Duluth, Minnesota. From *Field & Stream*, 1929.